BELLCOMM, INC.

SUBJECT: Trip Report - AAP 1A Definition Design Review, Martin Marietta Corp., Denver, December 13-15, 1967 Case 620

DATE: January 15, 1968

FROM: D. P. Woodard

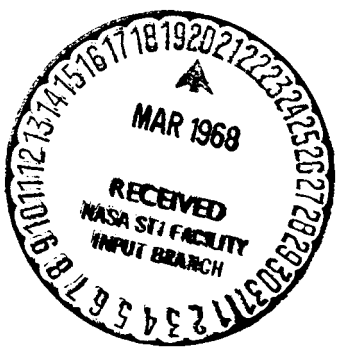
ABSTRACT

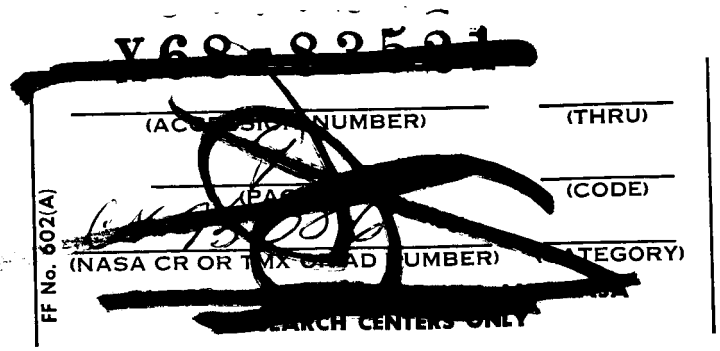
The AAP 1A Definition Design Review held at MMC, Denver, is discussed with emphasis on the Electrical Power and Distribution Subsystem (EPDS). The EPDS is described and changes requested by members of the working group are listed.

(NASA-CR-93386) TRIP REPORT - AAP 1A DEFINITION DESIGN REVIEW, MARTIN MARIETTA CORP., DENVER, DECEMBER 13-15, 1967 (Bellcomm, Inc.) 9 p

N79-72782

Unclas
00/33 11094





BELLCOMM, INC.
1100 Seventeenth Street, N.W. Washington, D.C. 20036

SUBJECT: Trip Report - AAP 1A Definition Design Review, Martin Marietta Corp., Denver, December 13-15, 1967 Case 620

DATE: January 15, 1968

FROM: D. P. Woodard

MEMORANDUM FOR FILE

A Definition Design Review for AAP 1A was held at Martin Marietta, Corp., Denver on December 13, 14, 15, 1967. Attending working group sessions from Bellcomm on December 13, 14 were Messrs:

M. S. Feldman - Attitude Control and Pointing Subsystem.
J. J. Gabrik - Environmental/Thermal Control Subsystem.
A. G. Weygand - Communications/Data Subsystem.
D. P. Woodard - Electrical Power and Distribution Subsystem.

As a brief background, MMC presented a final report of a 60 day study on September 20, 1967 at MSC which defined a CSM-docked carrier configuration into which was integrated 23 NASA designated applications, resource, and corollary experiments for the AAP 1A mission. Subsequent efforts have led to the subject review. The original list of 23 experiments has changed to a new list of 20 experiments as shown in the attached Table. Experiment change impact on the various mission phases and subsystems has not yet been fully worked in the MMC presentation material.

Comments on the Electrical Power and Distribution Subsystem (EPDS) follow:

EPDS DESCRIPTION

The EPDS schematic is attached, Figure 1, for the original 23 experiment list. Carrier power is obtained from 7, 28 volt (nominal), 400 ampere-hour, Eagle-Picher, LM descent batteries, paralleled through protective diodes to feed 2 main buses and 2 EMI buses. Bus selection is made through motor driven switches S-1, S-2, S-3, and S-4 located on the carrier and controlled from the Display and Control (D&C) panel using CSM power. Provision for paralleling main and EMI buses is obtained from S-6 and the AC bus is energized through S-5. Both S-5 and S-6 are operated by carrier power through D&C panel switches. Shunts between each battery and the single point ground (SPG) provide telemetry monitoring of individual battery currents through the Data Management System (DMS). The two additional shunts, in series with the bus load returns, meter bus currents for D&C panel display. Main and EMI bus voltages are displayed on the D&C panel and input to the DMS.

The AC bus voltage, 400 hz, 3ϕ, 200 volts line-to-line, is monitored by the DMS as are the 3 AC/DC converter regulated outputs. Regulated voltage is required by the DMS, the RCA Tape Recorder (if this type is selected for use)*, and experiments S039 and S049.

The dividing line between the unpressurized and pressurized portions of the carrier is indicated by the dashed line. No power appears in the pressurized carrier volume until the D&C panel is retrieved from the carrier, installed in the CM, and the motorized switches are operated. Carrier lights, needed for carrier ingress and D&C panel retrieval, are consequently powered by the CM. Experiments requiring DC power during launch are connected in a manner shown by T004 (not now on the 20 experiment list). AC power or regulated DC power is not available until D&C panel activation.

Protection is provided for each load through the bus circuit breakers as shown. Breakers such as CB "A" and CB "B" feeding loads powered during launch are not accessible, and breaker openings will result in power interruption; however the path is redundant in this case. The distribution system is protected against individual battery loss by the diodes.

The individual loads are controlled remotely from the D&C panel as shown schematically in Figure 2. 3-61 pin connectors (183 pins) are provided across the carrier - CM interface.

WORKING GROUP RECOMMENDATIONS

A number of changes in the EPDS, as described above, were requested by members of the working group in the form of Review Item Dispositions (RID's) for further consideration and review. These are listed below:

1. Delete the circuit breakers on the D&C panel that are in series with breakers in the carrier pressurized area. The carrier breakers are considered to provide adequate circuit protection. (See Figures 1 and 2).

2. Use CSM D.C. power for the carrier atmosphere circulation blower. Use of the CSM powered carrier light circuit would eliminate need for additional switch and interface pins and insure that the blower is on prior to carrier ingress by the crew.

---

*A Leach, AC, tape recorder is under consideration for this application.

3. Provide a redundant AC/DC converter for the carrier DMS system and associated controls and displays. (See Figure 1) Loss of the carrier DMS power would make it impossible to accomplish many mission objectives.

4. Provide a redundant AC power source for the carrier. MMC was requested to trade-off use of a redundant Static Inverter (Figure 1) in the carrier versus use of the CSM AC system for backup. North American is to furnish CSM AC power capability to MMC in this connection. Additional controls and displays will be needed.

5. Update the existing carrier profile (PR 29-21) to the new 20 experiment list and provide adequate spare battery capacity. A preliminary review of the new experiment list indicates an increase in total KWH required.

6. Add a special inverter/converter to power S049 (new list) or modify S049 to operate from the nominal 28 volt d.c. bus voltage. S049 requires a regulated supply and must be powered during launch. No provisions exist to do this now.

7. Provide Main Bus A&B shunt data (bus currents) to the DMS for ground use as well as to the D&C panel.

8. Provide EMI Bus A&B shunt data to the DMS, similar to (7).

9. Provide an ampere-hour meter so that total energy consumption can be monitored from the ground and mission can be modified in case of a power shortage.

10. Use spare pins in carrier-CM interface connectors to provide redundant turn-on capability for mission critical functions and experiments. (See Figure 2)

The working group agreed with the above items with the possible exception of (7) and (8). It was generally felt that although telemetry data on bus currents would relieve processing of the individual battery current data on the ground, this additional DMS input would be superfluous.

In addition, not pointed out during the working session, the EPDS is not protected should a short occur between

the battery protective diodes and motor driven switches S-1, 2, 3, and 4, or on through to the buses if these switches are operated. Additional breakers or protective devices should be added.

Handout material presented by MMC is available.

1022-DPW-dmc

D. P. Woodard

Attachments
Table 1
Figures 1 and 2

MISSION 1A EXPERIMENT LISTS

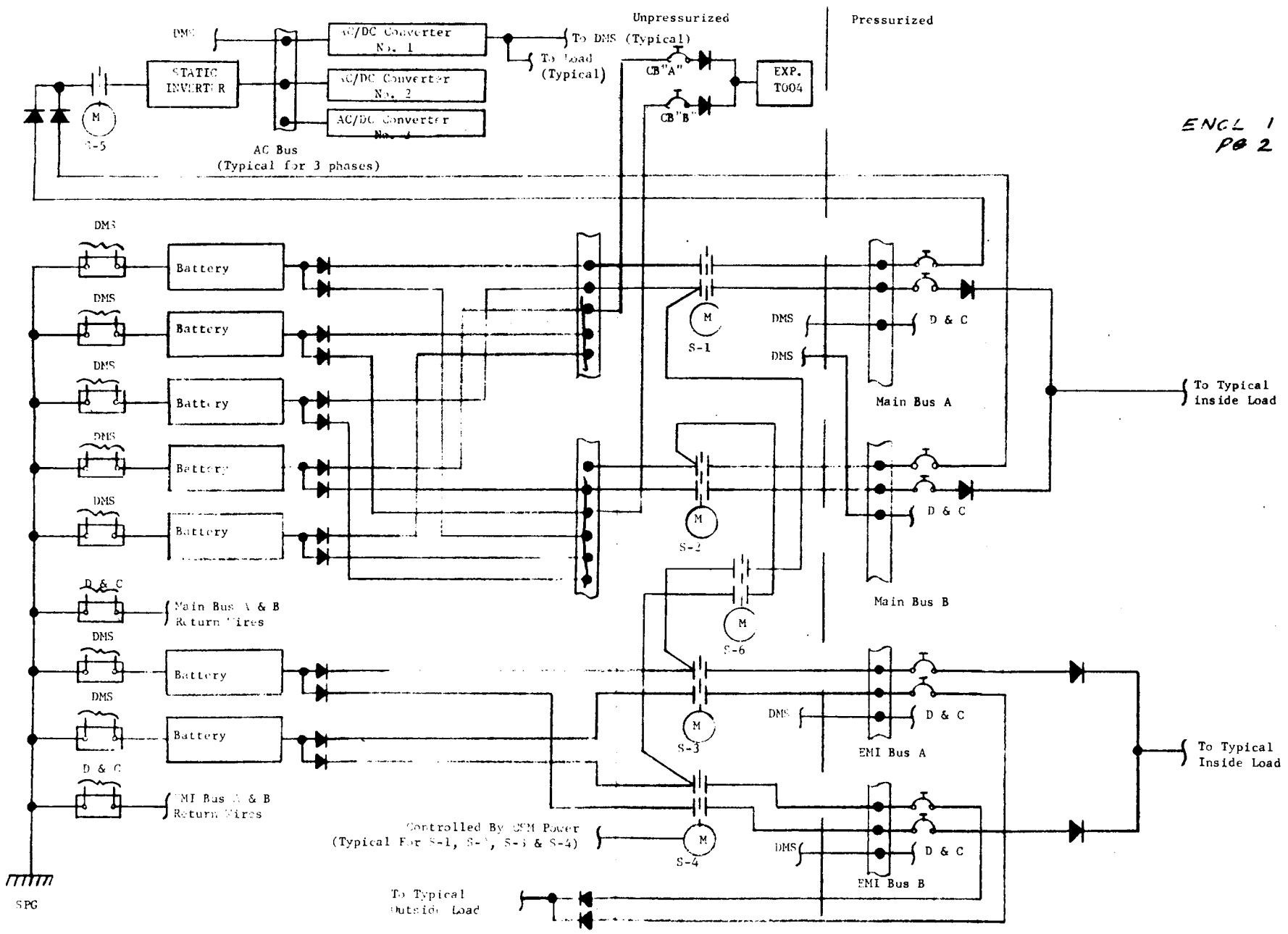
12/13/67

MARTIN MARIETTA CORPORATION
DENVER DIVISION

BASELINE 23 EXPTS.		NEW 20 EXPTS*		SAME
DAY/NIGHT CAMERA	S039	S039	DAY/NIGHT CAMERA	X
DIELECTRIC TAPE CAMERA	S040			
IR TEMPERATURE SOUNDING	S043	S043	IR TEMPERATURE SOUNDING	X
UHF SFERICS	S048			
IR SPECTROMETER	E06-9B	S049	IR INTERFEROMETER SPECTROMETER	
IR RADIOMETER	E06-9A	S050	IR TEMP PROFILE RADIOMETER	
ELECT SCANNED MW RADIOMETER	S044A	S075	ELECT SCANNED MW RADIOMETER	X
METRIC CAMERA	E06-1	S100	METRIC CAMERA/STELLAR	
MULTISPECTRAL CAMERA	E06-4	S101	MULTISPECTRAL PHOTOGRAPHY	X
IR IMAGER	E06-7	S102	IR DUAL CHANNEL SCANNER	
		S103	SHORT WAVELENGTH SPECTROMETER	
MULTIFREQ MW RADIOMETER	E06-11	S104	MW TEMPERATURE SOUNDER	
		S105	RADAR ALTIMETER SCATTEROMETER	
INFLIGHT NEPHELOMETER	T003	T003	AEROSOL PARTICLE ANALYZER	X
ZERO G HUMAN CELL	S015	S015	ZERO G HUMAN CELL	X
UV STELLAR ASTRONOMY	S019	S019	UV STELLAR ASTRONOMY	X
MICROMETEORITE COLLECTION	S018	S018	MICROMETEORITE COLLECTION	X
UV X-RAY SOLAR PHOTOGRAPHY	S020	S020	UV X-RAY SOLAR PHOTOGRAPHY	X
CO_2 REDUCTION	D017	D017	CO_2 REDUCTION	X
RADIATION MONITORS	D008	D008	RADIATION IN SPACECRAFT	X
SIMPLE NAVIGATION	D009	D009	SIMPLE NAVIGATION	X
MANUAL NAVIGATION	T002	T002	MANUAL NAVIGATION	X
FROG OTOLITH FUNCTION	T004			
TRAPPED PARTICLE ASSYMETRY	S016			
X-RAY ASTRONOMY	S017			

*(REF: TWX 7W16234)

Table 1



ENCL 1
PG 2

FIGURE I - ELECTRICAL POWER & DISTRIBUTION SUBSYSTEM SCHEMATIC

Figure 1

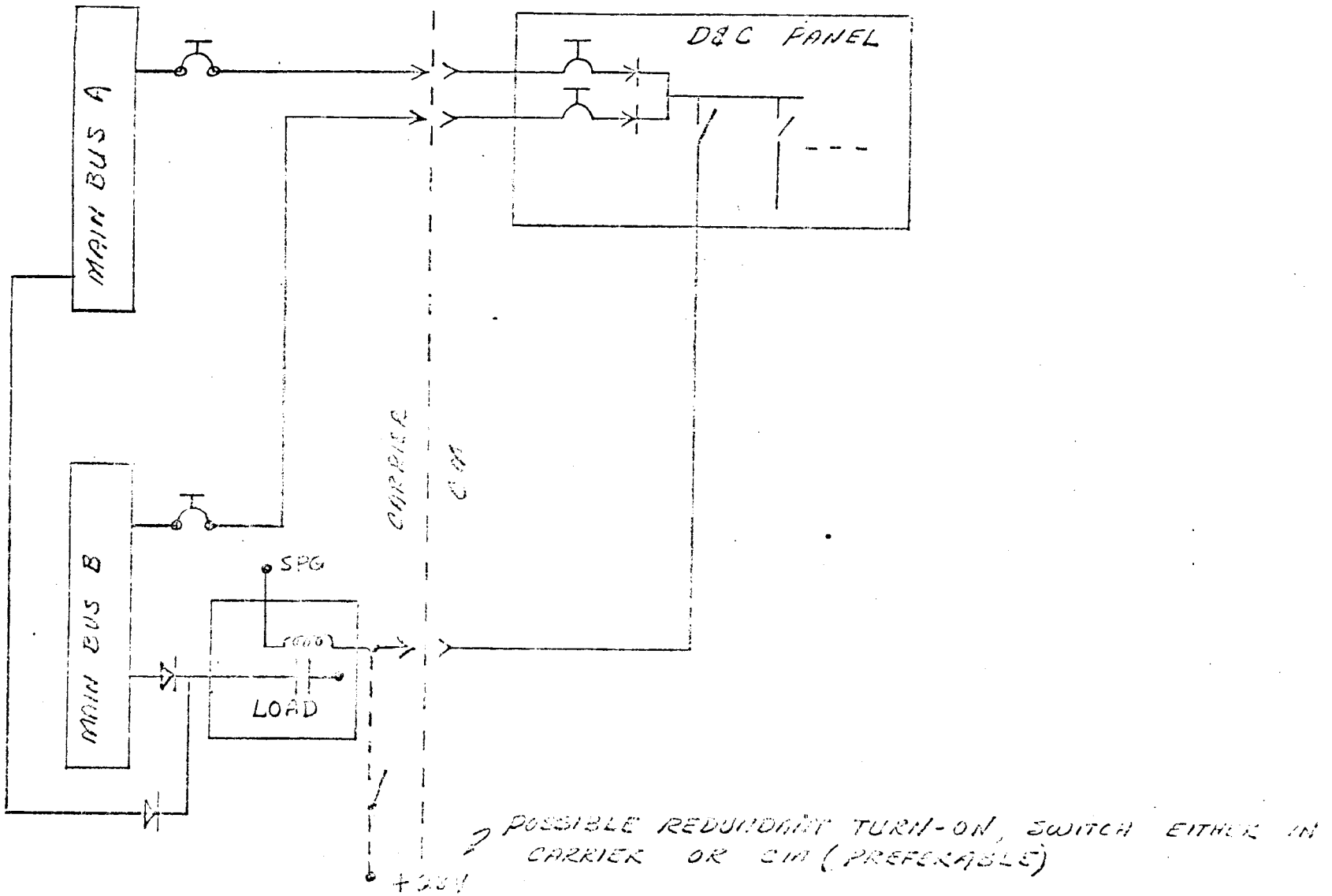

MAIN BUS A
D&C PANEL
CARRIER
C/M
MAIN BUS B
SPG
LOAD
+28V
? POSSIBLE REDUNDANT TURN-ON SWITCH EITHER IN CARRIER OR C/M (PREFERABLE)

Figure 2

BELLCOMM, INC.

Subject: Trip Report - AAP 1A Definition Design Review, Martin Marietta Corporation, Denver, December 13-15, 1967

From: D. P. Woodard

Distribution List

NASA Headquarters

Messrs. H. Cohen/MLR
P. E. Culbertson/MLA
J. H. Disher/MLD
J. A. Edwards/MLO
L. K. Fero/MLV
J. P. Field, Jr./MLP
T. A. Keegan/MA-2
C. W. Mathews/ML
M. Savage/MLT

Bellcomm

Messrs. A. P. Boysen
D. R. Hagner
W. C. Hittinger
B. T. Howard
J. Z. Menard
I. D. Nehama
I. M. Ross
R. L. Wagner
Div. 101 Supervision
All Members Dept. 1021, 1022, 1024
Department 1023
Central File
Library